

FAULT DETECTION EQUIPMENT

Economic and competitive pressures on the railroads over the decades since World War II have brought steadily increasing train speeds and heavier trains. Those same pressures have also resulted in fewer people, both on board trains and in wayside jobs such as agents, track and signal maintenance personnel, and tower operators, who are able to observe the condition of the railroad and of passing trains.

The result has been a proliferation of wayside devices that automatically monitor trackside conditions and passing trains and send a warning when they detect an unsafe or potentially hazardous condition.

These systems include wayside condition detectors such as rock slide fences and mud slide detectors, and high water or earthquake detectors, which have been in use for many years. Newer devices are

the equipment hazard detectors such as the familiar hot-bearing detectors (HBDs), along with hot-wheel detectors, dragging equipment detectors, broken wheel flange, loose wheel, and wheel

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impact (flat wheel) detectors, and clearance (high/wide load) detectors.

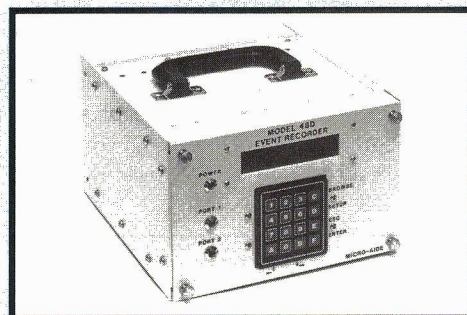
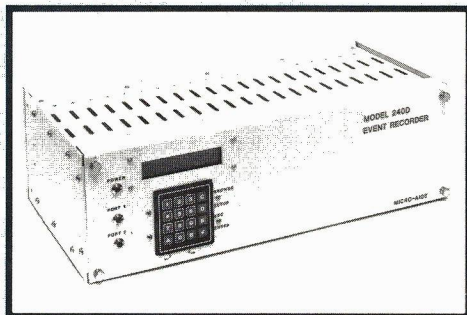
Where signal systems are in service, the output controls of these hazard warning detectors are often tied in with the signals. Thus, when a detector operates, a signal in advance of the hazard location (for wayside condition detectors) or just

beyond the detector location (for equipment hazard detectors) is set to stop. Today it is becoming standard to equip hot bearing detector and dragging equipment detector locations with VHF voice radio to alert the train crew to a defect, and also to inform the crew of the location of the defect reading. This is especially important due to the elimination of cabooses on most major roads. Several railroads also transmit the results of HBD scans to a train dispatcher's office or to a central office so that the detector operation can be subjected to computer analysis.

The widely used infrared hot-bearing detector was developed to address the problem of the large number of failures on equipment using friction bearings. Infrared detectors are located typically about 20 to 50 miles apart on main line routes.

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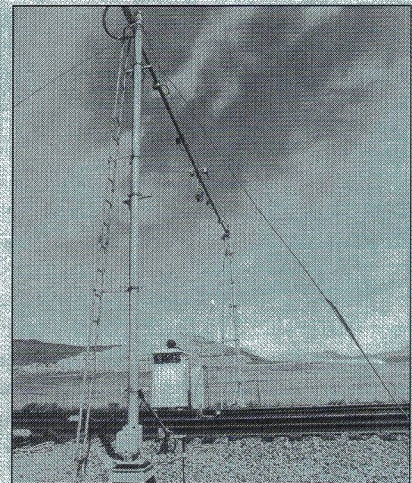
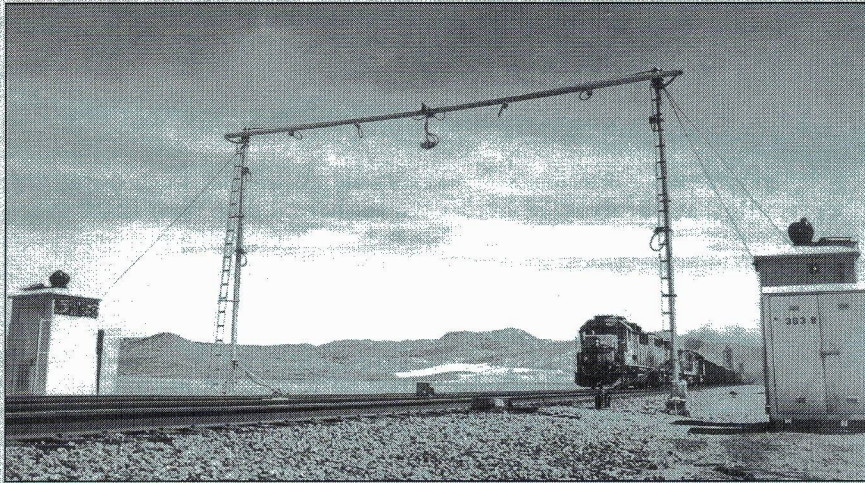
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But now that roller bearings are the standard, the problem is different. While roller bearings have relatively few failures, the failures that do occur often develop very quickly. A bearing that registers normal heat as it passes an infrared detector location may become distressed, heat up rapidly, and fail within just a few miles. It would be prohibitively expensive to install standard infrared detectors at close enough intervals to detect such quickly-developing bearing failures. But there are other approaches that are being tried.

One is detection of defective bearings through acoustical defect signature processing. This technique has been under development and testing for a number of years, and is being used experimentally on several railroads.

Acoustical detection is based on the analysis of the characteristic "sound signatures" of the bearings, which are picked up by wayside sensors at the detector location. The sounds picked up by the sensors are processed to isolate the bear-

ing signature sounds so they can be analyzed. As a bearing defect begins to develop, its characteristic sound changes—long before the defect reaches the point where failure is imminent. Acoustical technology might also be able to detect bearings that do not require immediate attention but should be checked out at the next convenient opportunity. This could avoid unnecessary stopping of trains.

Acoustical detection equipment can be and usually is installed at a location that already has infrared detectors. Thus, if an acoustically-detected defect is found and the bearing also has abnormal heat, failure is probably imminent and the train should be stopped. If an acoustical bearing defect is detected but there is no abnormal heat, the car can continue to destination but should be inspected as soon as possible. This early detection capability could allow corrective action to be taken on an economical, non-emergency basis.

So far, development work on acoustical detection has concentrated on detecting raceway spalling. The results so far

are said to be promising. About 85% to 90% of bearings that have triggered acoustic detectors have been determined, either by tear-down or through the AAR hand roll test, to have condemnable defects.

Some industry engineers stress that acoustical detection is an unproved technology and question whether it can ever become a reliable method of bearing evaluation. However, a few acoustical detec-

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tors are in experimental operation on Burlington Northern, Union Pacific, Conrail and Canadian National.

One of the roads skeptical of acoustical



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detection is Norfolk Southern, which has taken its own approach to the problem of detecting fast-growing defects in roller bearing cars. NS engineers came up with a simplified infrared detector that produces a basic go/no go reading. Developed with Southern Technologies, the system is less sophisticated but also less expensive to buy and install than conventional, more elaborate infrared detectors. As a result, NS can afford to use more detectors, and is moving toward a goal of spacing them only 10 miles apart on lines where such spacing is desirable. The former Southern Railway part of the NS system now has about 500 detectors; on the former Norfolk & Western, HBDs are being respaced and new ones added.

Wheel impact load detectors, which have been in limited use for some years now, promise to become a popular item now that the industry is finally facing up to the problems caused by out-of-round wheels. With today's high speeds and heavy loads, such wheels produce impact loads that are damaging to the cars, the customers' freight, the rails, and the ties—especially concrete ties.

This year the AAR Mechanical Division approved a rule which allows car

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owners to be billed for the removal and replacement of out-of-round wheels that produce wheel impact load detector readings greater than 100,000 pounds, and which are verified to have a runout exceeding .050 inch.

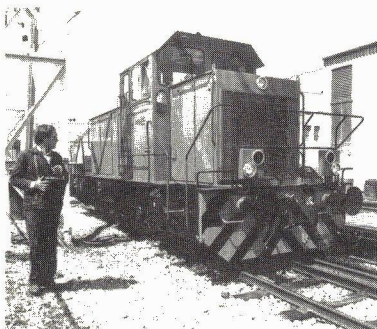
Salient Systems, which makes wheel impact load detectors, is also developing two new hazard detectors. One is a detector to catch skewed or hunting car trucks,

"bad actors" whose constant lateral vibration can damage lading and car structure, increase the wear on truck components and wheels, and affect the safety of train operation.

Another new device being tested is an overloaded-car detector. It's said to be able to weigh cars at train speed and report any cars that are overweight, and if so by how much. □



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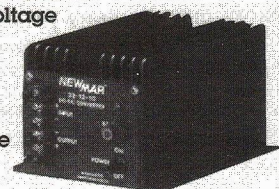


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